

Two-photon polymerization of embedded features within self-assembled photonic crystals

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Three dimensional (3D) photonic bandgap materials have been proposed as the basis of many devices, the majority of which rely on the incorporation of aperiodic defects to provide functionality. We introduced and demonstrated the use of two-photon polymerization (TPP) for the fabrication of embedded features within self-assembled colloidal crystals.^[1] This was the first identification of a technique capable of defining engineered 3D defects within this class of photonic crystals. We will discuss our unique modulated beam rastering approach to TPP and will introduce TPP phase diagrams that enable the visualization of the polymerization window.^[2] We will present phase diagrams as a convenient means to evaluate the efficiency of different initiator systems as well as the impact of a colloidal crystal on the TPP response. Additionally, we will demonstrate the incorporation of high resolution optically interesting TPP features within silicon-air inverse opals and will present preliminary spectroscopy of these structures.

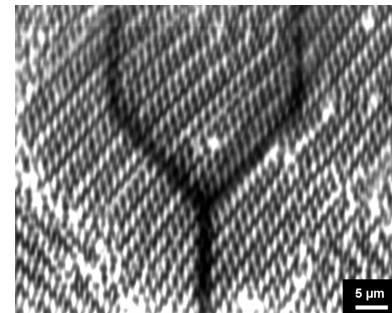


Figure 1. Fluorescence laser scanning confocal micrograph of a vertical cross-section through a TPP feature embedded within a self-assembled colloidal crystal.

[1] W. Lee, S. A. Pruzinsky, and P. V. Braun, *Advanced Materials*, **14**, 271 (2002).

[2] S. A. Pruzinsky and P. V. Braun, *Advanced Functional Materials*, submitted.